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10/528,963	03/16/2005	Xiao-fan Feng	7146.0329	9041

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KEVIN L. RUSSELL
CHERNOFF, VILHAUER, MCCLUNG & STENZEL LLP
1600 ODSTOWER
601 SW SECOND AVENUE
PORTLAND, OR 97204

EXAMINER	
YEH, EUENG NAN	
ART UNIT	PAPER NUMBER
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/528,963	FENG ET AL.	
	Examiner	Art Unit	
	EUENG-NAN YEH	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *28 February 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

FINAL ACTION

Response to Amendment

1. The following Office Action is responsive to the amendment and remarks received on February 28, 2008. Claims 1-25 remain pending.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Watson (US 5,426,512), Jones et al. (US 6,349,151 B1), and Fleet et al. (US 5,949,055).

Regarding 1, Watson discloses a compression system comprising:

(a) providing an image (as depicted in figure 2, numeral 30 is the image);

(b) quantizing a discrete cosine transform of said image using a first set of quantization values (as depicted in figure 2, numerals 34 and 38 for discrete cosine transform, DCT, and quantization, respectively. "The invention is directed to digital compression of images, comprising a plurality of blocks of pixels, that uses the DCT transform coefficients yielded from a Discrete Cosine Transform (DCT) of all the blocks as well as

other display and perceptual parameters all to generate a quantization matrix which, in turn, yields a reproduced image having a low perceptual error" at column 3, line 45. See also: “transforms a block of pixels … applying a Discrete Cosine Transform (DCT), selecting a DCT mask (m_{ijk}) for each block of pixels, and selecting a quantization matrix (q_{ij}) for quantizing DCT transformation coefficients (c_{ijk}) produced by the DCT transformation …" at column 3, line 56);

(c) quantizing said discrete cosine transform of said first image using a second set of quantization values (discussed at column 3, line 54 to column 4, line 10, the quantization values q_{ij} "adjusting the values of q_{ij} up or down" at column 4, line 8, to have the second, i.e. modified, set of q_{ij} to perform the quantization);

(f) selecting one of said first set of quantization values and said second set of quantization values ("…adjusting the values of q_{ij} up or down until each entry in the perceptual error matrix P_{ij} is within a target range" at column 4, line 8. Thus, the desired quantization values of q_{ij} can be selected among the tested set of quantization values).

Watson discloses a compression system with optimized quantization, "present invention, as already discussed, provides for visual masking by luminance and contrast techniques as well as by error pooling" at Watson column 10, line 59. Watson does not explicitly disclose the quantization values do not depend on said image. Furthermore, Watson does not explicitly disclose that values optimized are based on model comparison.

Jones, in the same field of endeavor of image processing (“a method of controlling the rate and quality of compressed image” at column 1, line 17), teaches a

plurality of quantization tables, Q-tables, "… multiple Q-tables (needed to achieve the gamut of compressed file sizes) based on perceptual considerations that correlate well with perceived quality" at column 3, line 29. See also, "each Q-table is indexed with a quality parameter. An example of a quality parameter is the viewing distance for which the image (which has been compressed and decompressed using the corresponding Q-table) will manifest no perceptual loss if viewed by an observer" at column 3, line 41. Furthermore, "a preferred embodiment of this invention, response characteristics of the human visual system (HVS) are used to derive a plurality of Q-tables. In generating the appropriate Q-table values from an HVS model, parameters for the viewing conditions and display rendering are required" at column 4, line 48. Thus, the quantization values from plurality of quantization tables (or a second set of quantization values stated in claim 1 (c)) used by Jones image compression/decompression are generated based on perceptual considerations not on image data as stated in claim 1 (c). Without departing from the scope and spirit of Jones' methodology the modulation transfer characteristic of a display can affect the human visual system and should be used as one of the quality parameters.

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the compression system of Watson, with HVS Q-tables as taught by Jones, to provide "a means of generating a plurality of Q-tables based on a model of the human visual system that result in improved image quality" at column 3, line 67.

The Watson and Jones combination does not explicitly disclose that values optimized are based on model comparison.

Fleet, in the same field of endeavor of information decoding ("a processor-based technique in the field of information decoding" at column 1, line 15), teaches "… a way of measuring the perceptual difference between the original and modified color images and to control the acceptability of this perceptual difference" at column 8, line 51. As depicted in figure 8, numeral 458 "… [t]he conventional CIELAB color difference formula is then used to measure the perceptual difference at each image pixel between a color in the original color image and a color in the current version of the modified color image …" at column 13, line 50. Thus, Fleet's color visual difference model can be used to compare the perceptual difference between input image and the reconstructed image (claims 1 (d) and (e)) to perform the selection as stated in claim 1 (f).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to provide the compression system of the Watson and Jones combination, with perception model to do the image comparison as taught by Fleet, for "the well-known CIELAB standard that attempts to define a perceptually uniform color space in which color reproduction errors can be accurately measured" at column 12, line 66, such that proper quantization values can be selected.

Regarding claim 2, scaling the selected one of said first set of quantization values and said second set of quantization values if a comparison of said image to said spatial reconstructed image produces an error metric between an upper threshold and a

lower threshold (as discussed in claim 1 for the selecting one quantization values, wherein the values "...adjusting the values of q_{ij} up or down until each entry in the perceptual error matrix P_{ij} is within a target range" at Watson column 4, line 8).

Regarding claim 3, first set of quantization values is based upon, at least in part, the color primaries of a display (as depicted in Watson figure 3, numeral 72 inputs the display and perceptual parameters to generate the quantization optimizer matrix 36. See also Fleet figure 7, numeral 404 "Original color image 404 is converted, in box 406, to an opponent color representation which produces three color separations: luminance (black and white). red-green (RG) and yellow-blue (YB). This conversion is a linear transformation, typically from RGB color space" at Fleet column 11, line 3).

Regarding claim 4, said first set of quantization values is based upon, at least in part, the modulation transfer function of a display (as discussed in claim 1, the Watson and Fleet combination teaches optimized quantization values based on display and perceptual parameters (as depicted in Watson figure 3 and see also column 7, line 8 to column 8, line 33) and human perception model to select the quantization values (as depicted in Fleet figure 1 and see also column 8, lines 23 to 53. Jones teaches "... multiple Q-tables (needed to achieve the gamut of compressed file sizes) based on perceptual considerations that correlate well with perceived quality" at column 3, line 29. See also, "each Q-table is indexed with a quality parameter. An example of a quality parameter is the viewing distance for which the image (which has been compressed

and decompressed using the corresponding Q-table) will manifest no perceptual loss if viewed by an observer" at column 3, line 41. Furthermore, "a preferred embodiment of this invention, response characteristics of the human visual system (HVS) are used to derive a plurality of Q-tables. In generating the appropriate Q-table values from an HVS model, parameters for the viewing conditions and display rendering are required" at column 4, line 48. Without departing from the scope and spirit of Jones' methodology the modulation transfer characteristic of a display can affect the human visual system and should be used as one of the quality parameters which affect the selection of quantization values).

Regarding claims 5-10, 12-13 (discussed in claims 1 and 4 for a compression system based on display and human visual perception).

Regarding claim 11, said model collapses to CIELAB for large patches of color (as discussed in 1, the model with CIELAB is suitable to define a perceptually uniform color space).

Regarding claim 14, said selecting is based upon an error measure (discussed in claim 1, the error was measured "… [t]he conventional CIELAB color difference formula is then used to measure the perceptual difference at each image pixel between a color in the original color image and a color in the current version of the modified color image …" at Fleet column 13, line 50.).

Regarding claim 15, a first error measure based upon said comparing of said first set and a second error measure based upon said comparing of said second set (discussed in claim 1, the error measurement is based on reconstructed image which corresponding to quantization values selected).

Regarding claim 16, said selecting is based upon said first and second error measures (discussed in claim 1f, for the selection).

Regarding claim 17, modifying said selected set of quantization values based upon said error measure (discussed in claim 1, error measurement is used for further adjustment to derive desired quantization values "…adjusting the values of q_{ij} up or down until each entry in the perceptual error matrix P_{ij} is within a target range" at Watson column 4, line 8).

Regarding claim 18, modifying said image based upon said modified selected set of quantization values (discussed in claim 1, the reconstructed image is based on modified selected set of quantization values "… generate a quantization matrix which, in turn, yields a reproduced image having a low perceptual error" at Watson column 3, line 50).

Regarding claim 19, said modified image is encoded (discussed in claim 1, modified image is based on quantized values i.e. image is encoded "comprises a further step of entropy coding the digital representation of the image" at Watson column 4, line 11).

Regarding claim 20, an image encoding system comprising:

(a) providing a first image (discussed in claim 1a, providing an image);

(b) quantizing a discrete cosine transform of said first image using a first set of quantization values (discussed in claim 1b, quantizing a DCT);

(c) comparing said first image to a spatial reconstructed image based upon said first set of quantization values using a model to determine an error measure (discussed in claim 1 for error measurement from model comparison "… a way of measuring the perceptual difference between the original and modified color images and to control the acceptability of this perceptual difference" at Fleet column 8, line 51. As depicted in Fleet figure 8, numeral 458 "… [t]he conventional CIELAB color difference formula is then used to measure the perceptual difference at each image pixel between a color in the original color image and a color in the current version of the modified color image …" at column 13, line 50);

(d) based upon said error measure, scaling said first set of quantization values by applying a single common scaling factor to each quantization value within said first set of quantization values (discussed in claim 1, error measurement is used for further adjustment to derive desired quantization values "…adjusting the values of q_{ij}

up or down until each entry in the perceptual error matrix P_{ij} is within a target range" at Watson column 4, line 8), said scaling factor having a value not dependent on information from said first image (as teach from Jones "a preferred embodiment of this invention, response characteristics of the human visual system (HVS) are used to derive a plurality of Q-tables …" at column 4, line 48. Thus, the scaling factor having a value not dependent on information from said first image);

(e) quantizing said discrete cosine transform of said first image using said modified first set of quantization values (discussed in claim 1c, to quantize the first image with second, i.e. modified, set of quantization values).

Regarding claims 21 and 23 for scaling factor increased for error measure is less than a threshold ("… if the element of the perceptual error matrix is less than the target parameter Ψ, the corresponding entry (segment 56) *(figure 3)* of the quantization matrix is incremented …" at Watson column 9, line 45).

Regarding claims 22 and 24 for scaling factor decreased for error measure is greater than a threshold ("… if the element of the perceptual error matrix is greater than the target parameter Ψ, the corresponding entry (segment 56) *(figure 3)* of the quantization matrix is decremented. …" at Watson column 9, line 48).

Regarding claim 25, an image encoding system comprising:

(a) providing a first image (discussed in claim 1a, providing an image);

(b) quantizing a discrete cosine transform of said first image using a first set of quantization values (discussed in claim 1b, quantizing a DCT);

(c) quantizing said discrete cosine transform of said first image using a second set of quantization values different from said first set of quantization values, and where neither said first set of quantization values nor said second set of quantization values are calculated using data from said image (discussed in claim 1c, quantizing said DCT of said first image using second set of quantization values);

(d) comparing said first image to a spatial reconstructed image based upon said first set of quantization values using a model to determine an error measure (discussed in claim 1d for error measurement from model comparison);

(e) comparing said first image to a spatial reconstructed image based upon said second set of quantization values using said model to determine an error measure (discussed in claim 1e for error measurement from model comparison);

(f) selecting one of said first set of quantization values and said second set of quantization values based upon respective said error measures (discussed in claim 1f for the quantization value selection);

(g) based upon said error measure scaling the selected said one said set of quantization values (discussed in claim 2);

(h) quantizing said discrete cosine transform of said first image using said modified set of quantization values (discussed in claim 1c, to quantize the first image with second, i.e. modified, set of quantization values).

Response to Arguments

a. Summary of Applicant's Remark:

The previous specification objections should be withdrawn in view of the amendment.

Examiner's Response:

Examiner agrees, and the previous objections are withdrawn.

b. Summary of Applicant's Remarks:

"'neither said first set of quantization values nor said second set of quantization values are calculated using data from said image.' This limitation is not disclosed by the cited prior art" at response page 9, line 12.

"Independent claim 20, as amended, recites the limitation of "based upon said error measure, scaling said first set of quantization values by applying a single common scaling factor to each quantization value within said first set of quantization value, said scaling factor having a value not dependent on information from said first image s." This limitation is not disclosed by the cited prior art. Watson, though iteratively updating a quantization matrix, scales each individual value in the quantization matrix by a unique scaling divisor retrieved from a DCT mask 70 computed, in part, using image DCT coefficients" at response page 10, line 4.

Examiner's Response:

Applicant's argument is moot in view of the new grounds of rejection advanced herein above. Specifically, the combination with Jones et al. (US 6,349,151 B1)

reference now teaches that quantization values do not depend on the input data “a preferred embodiment of this invention, response characteristics of the human visual system (HVS) are used to derive a plurality of Q-tables ..." at Jones column 4, line 48. Refer to the rejections above for detail discussions.

Conclusion

4. Applicant's amendment is rejected in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eueng-nan Yeh whose telephone number is 571-270-1586. The examiner can normally be reached on Monday-Friday 8AM-4:30PM EDT.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Eueng-nan Yeh
Assistant Patent Examiner
Art Unit: 2624
/E.Y./

/Vikkram Bali/
Supervisory Patent Examiner, Art Unit 2624